

SECTION M5

PIPE, CULVERT SECTIONS AND CONDUIT

M5.00.0 Pipe, Culvert Sections and Conduit.

These shall consist of individual sections of the kinds and sizes shown on the plans and as directed. They shall conform to the requirements of the applicable following subsections.

All pipes shall be subject to inspection at the point of manufacture as well as the site of the work. The purpose of the inspection shall be to cull and reject pipes which, independent of the physical tests, fail to conform to the specification in the particulars of dimension, workmanship, finish, blisters, cracks or fractures.

M5.01.0 Clay Pipe.

Clay Pipe for use in the construction of culverts, drains, and sewers shall conform to the requirements of AASHTO M 65 for Extra Strength Clay Pipe, except that the minimum average strength per meter by the three-edge bearing method for 300 millimeters and less diameter pipe shall be 35 kiloNewtons.

M5.02.0 Cement Concrete Pipe.

Cement Concrete Pipe shall conform to the requirements of AASHTO M 86 Class 2. The hydrostatic test will only be required for concrete pipe to be used in sewer construction. Unless otherwise provided, all cement concrete pipe shall be of the bell and spigot type.

M5.02.1 Reinforced Concrete Pipe.

Reinforced concrete pipe shall conform to the requirements of AASHTO M 170 for Standard Strength Reinforced Concrete Culvert Pipe for Class III Pipe, unless otherwise designated on the plans, except that the steel area for 600 millimeter pipe shall be 230 square millimeters per meter and circular reinforcement only shall be used in circular pipes. All pipe 600 millimeters in diameter or smaller shall be of the bell-and-spigot type. Pipes larger than 600 millimeters in diameter shall be tongue and groove or bell and spigot.

M5.02.2 Reinforced Concrete Pipe Flared Ends.

Flared End Sections shall be fabricated to comply with the current construction standard for this item. The method of fabrication and materials used shall conform to the requirements of AASHTO M 170, Class III, except that the three edge bearing tests shall not be required. The flare shall be of the same thickness and materials as the barrel and have steel reinforcement equaling or exceeding the amount shown on the table for AASHTO M 170, Class III, except that a double row of steel will not be required.

M5.03.0 Corrugated Metal Pipe.

This pipe shall consist of metallic coated (galvanized or aluminized) corrugated metal pipe and couplings. Galvanized pipe and couplings shall be completely coated inside and out with an asphalt cement. Aluminized pipe need not be asphalt coated. Aluminized and galvanized pipe components shall not be used together in a pipe run. Unless otherwise shown on the plans and/or called for in the Proposal, the thickness of the metal may be any one of those allowed for the size of pipe in the AASHTO designation below:

A. The pipe shall conform to AASHTO M 36. Pipe 200 millimeters or less in diameter shall be constructed of sheets not lighter than 1.32 millimeters in thickness.

B. The asphalt coating for the galvanized pipe shall conform to AASHTO M 190, Type C coating. The asphalt coating for galvanized coupling bands shall conform to Type A coating.

C. If Strutting of the Pipe is required it will be done as follows:

1. The pipe shall be elongated by the manufacturer, after fabrication, by reducing the horizontal diameter three percent and increasing the vertical diameter three percent, and held in the elongated shape by means of rods, all in accordance with this specification.

2. The rods shall be 15 millimeter diameter threaded 180 millimeters at both ends with washer and nuts. The length of the rods shall be the diameter of the pipe plus 200 millimeters. The rods shall be placed on the horizontal axis of the pipe on 600 millimeter spacing and located at the halfway point between the circumferential riveting.

3. A soft wood block 50 millimeters x 100 millimeters x 300 millimeters long shall be placed over the rods at each end to provide contact against the outside of the pipe. The long dimension of the blocks shall be parallel with the horizontal axis of the pipe in order to prevent distortion of the pipe when the nuts are tightened.

4. The three percent elongation shall be obtained by tightening on the rods uniformly from end to end of the pipe, obtaining approximately one quarter of the required elongation each time through the length of the pipe.

5. The rods shall be left in the pipe until the fill is completed and well compacted, unless for some unusual condition their removal is ordered by the Engineer.

6. The rods shall be removed by the Contractor by cutting from the inside adjacent to the pipe. The three percent of ellipse shall be subject to manufacturing tolerances.

D. When elongation of the pipe is specified, but strutting is not required, the elongation may be accomplished by the fabricator prior to delivery in the following manner:

The pipe shall be elongated by the manufacturer, after fabrication, by reducing the horizontal diameter five percent and increasing the vertical diameter five percent by mechanical pressure sufficient to produce a permanent distortion in the pipe. The elongation shall be maintained by drilling of holes in the ends of sections of pipe and placing horizontal wires. After the pipe sections have been placed and coupling bands installed and prior to placing of backfill the wires shall be removed.

M5.03.1 Perforated Corrugated Metal Pipe.

This pipe shall consist of perforated metallic coated (galvanized or aluminized) corrugated metal pipe and couplings. Galvanized pipe and couplings shall be completely coated inside and out with an asphalt cement. Aluminized pipe need not be asphalt coated. Aluminized and galvanized pipe components shall not be used together in a pipe run.

A. The pipe shall conform to AASHTO M 36 except that under "1. End finish" reinforcing the ends of the pipe will not be required.

B. The asphalt coating for the galvanized pipe shall conform to AASHTO M 190 Type C, coating. The entire pipe shall be coated to a minimum thickness of 0.75 millimeter.

M5.03.3 Corrugated Aluminum Metal Pipe.

This pipe shall consist of corrugated aluminum alloy pipe and couplings. The fabrication of pipe, coupling, and thickness of sheets used shall conform with the relevant requirements of AASHTO M 196.

M5.03.4 Perforated Corrugated Aluminum Metal Pipe.

This pipe shall consist of perforated corrugated aluminum alloy pipe and couplings. The fabrication of pipe, coupling, and thickness of sheets used shall conform with the relevant requirements of AASHTO M 197.

M5.03.6 Metal End Sections.

Metal End Sections shall be fabricated to conform with the current construction standard for this item. The method of fabrication and materials used shall conform to the applicable requirements of AASHTO M 36.

After fabrication of end sections, the entire unit shall be coated with 2 coats of material conforming to Subsection M7.04.01.

M5.03.7 Plastic (PVC) Pipe.

Plastic (PVC) Pipe shall meet ASTM D 1785 Standard Specification for Poly Vinyl Chloride (PVC) and Chlorinated Poly Vinyl Chloride (CPVC) Plastic Pipe, Schedule 40, 80, and 120. The pipe shall be PVC, Type I Schedule 80. Fittings, such as adapters, couplings, etc. shall be the same material as the pipe. Joints shall be made in accordance with ASTM D 2855 Recommended Practice for Making Solvent-Cemented Joints with Polyvinyl Chloride (PVC) Pipe and Fittings. Cements shall meet ASTM D 2564.

M5.03.8 Polymeric Precoated Corrugated Metal Pipe.

Polymeric precoated corrugated metal pipe shall conform to the requirements of AASHTO M 246, Type B with the thinner polymeric coating a minimum of 0.075 millimeters.

M5.03.9 Slot-Perforated Corrugated Plastic Pipe.

This pipe or tubing shall consist of slot-perforated corrugated polyethylene tubing, couplings and fittings. Materials, dimensions, physical properties and fabrication shall be in conformance with AASHTO M 252.

M5.03.10 Corrugated Plastic Pipe.

This pipe or tubing shall consist of corrugated polyethylene tubing, couplings and fittings. Materials, dimensions, physical properties and fabrication shall be in accordance with AASHTO M 294.

Tubing used for drainage pipe shall have a smooth interior and shall have an inside diameter of 305, 380, 455, 535, 610, 760, or 915 millimeters.

Corrugated plastic (polyethylene) pipe shall not be used as flared ends or in other applications where the pipe will be exposed to vandalism and ultraviolet radiation.

M5.04.0 Asphalt Coated Corrugated Metal Pipe Arches.

Asphalt coated corrugated metal pipe arches shall consist of corrugated metal pipes which have been reformed to multi-centered pipe having arch shaped tops with a slight outwardly curved integral bottom. The pipe shall be fabricated from standard length culvert sheet and factory riveted to form a continuous length pipe arch.

Asphalt coated corrugated metal pipe arches, including coupling bands, shall conform to the requirement of AASHTO M 36 or AASHTO M 196 for corrugated metal pipe meeting the requirements for base metal, rivets, sampling, testing, brands, corrugations, end finish, mass, bands and workmanship.

FABRICATION

A. Dimensions.

Dimensions, tolerances, and areas shall be in accordance with AASHTO M 36 unless otherwise noted on the plans and/or called for in the proposal.

The lapped longitudinal seams shall be factory riveted and shall be placed in the top arch and be staggered so as to alternate on each side of the center of the top of the arch by approximately 15% of the periphery.

B. Asphalt Coating.

The insert of the pipe arch shall be coated with asphalt conforming to AASHTO M 190, Type C coating, so as to form a smooth pavement to widths of 40% of the circumference of the pipe arch. These widths are determined by 40% of the circumference of equivalent diameters. It shall be applied in such a manner that the corrugations are completely filled and that, except where the upper edges intersect the corrugations, the pavement has a minimum thickness of 3 millimeters above the crests of the corrugations. The remainder of the inside of the pipe arch and the entire outside shall be uniformly coated with asphalt cement to a minimum thickness of 1.3 millimeters. The

thickness shall be measured on the crests of the corrugations. All coupling bands shall be coated to the same requirements as the pipe arch except the pavement shall be omitted.

C. Bituminous Materials.

The asphalt cement used for coating shall conform to the requirements in M5.03.0, Section B.

M5.04.2 Structural Plate for Pipe and Pipe Arches.

All materials, including base metal analysis, galvanizing, bolts, nuts, corrugations, gauge determination and acceptance of plates, forming and punching holes, bearing shapes, fabrication and incidental items shall conform to AASHTO M 167 and the following:

A. The gauge of plates shall be as specified on the Plans.

B. Bituminous Coating for Metal Surfaces. The bituminous coating shall be a coal tar blend conforming to the requirements of M7.04.01.

M5.04.3 Asphalt Coated Smooth Steel Liner Helically Corrugated Shell Metal Pipe.

This pipe shall conform to AASHTO M 36, 8.1.1, Type 1A pipe. The coating shall conform to AASHTO Designation M 190, Type A.

M5.05.1 Cast Iron for Water Systems.

Cast iron pipe shall be centrifugally spun, bell-and-spigot type conforming to the requirements of ASA Standard A21.6 (AWWA-C106) or A21.8 (AWWA-C108) for Cast Iron Pipe Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids and shall be of the class called for on the plans or in the Special Provisions. When no class is specified on the plans or in the Special Provisions, Class 150 pipe shall be used. Cast iron fittings shall conform with ASA Standard A21.10 or AWWA Standard C100, Class D. When cement lining is called for the pipe and fittings shall be cement lined in accordance with the requirements of ASA Specification A21.4 (AWWA-C104) for Cement Mortar Lining. When bituminous coating is specified it shall conform to the requirements stipulated in Standards A21.6 or A21.8.

A. Hydrants.

Hydrants shall conform to the requirements of AWWA Standard C502 and/or to the type used by the particular municipality involved as specified in the Special Provisions.

B. Gate Valves.

Gate valves shall conform to the requirements of AWWA Standard C500 and/or to the type used by the particular municipality involved as specified in the Special Provisions.

M5.05.3 Ductile Iron Pipe and Fittings.

Ductile Iron Pipe shall conform to the requirements of ANSI A21.50 (AWWA C150) American Standard for Ductile Iron Pipe Centrifugally Cast in Metal Molds or Sand-Lined Molds for Water or Other Liquids and shall be of the class called for on the plans or in the Special Provisions.

Ductile iron fittings shall conform with ANSI A21.10 (AWWA C 110, latest revision) American Standard.

When cement lining is called for the pipe and fittings shall be cement lined in accordance with the requirements of ANSI A21.4 (AWWA C104I, latest revision) for Cement Mortar Lining for Ductile Iron Pipe and Fittings.

When bituminous coating is specified it shall conform to the requirements of ANSI A21.6 (AWWA C106, latest revision).

A. Hydrants.

Hydrants shall conform to the requirements of AWWA Standard C502, and/or to the type used by the particular municipality involved as specified in the Special Provisions.

B. Gate Valves.

Gate valves shall conform to the requirements of AWWA Standard C500 and/or to the type used by the particular municipality involved as specified in the Special Provisions.

M5.05.4 Acrylonitrile – Butadiene – Styrene (ABS) Pipe.

This type of pipe shall conform to the requirements of AASHTO M 265.

M5.06.0 Copper Tubing.

Copper Tubing shall conform to the requirements of ASTM B 88, Type k, “annealed”.

M5.07.0 Electrical Conduit-Rigid, Nonmetallic (Type NM).

The walls of the conduit shall have a smooth interior surface free from all substances which may injure any wire or cable covering such as is used on rubber covered or thermoplastic insulated wire or cable.

The bore of the conduit shall be circular in cross section and straight and true so as to pass freely a mandrel 1 meter long and 6 millimeters less in diameter than the nominal inner diameter of the conduit.

The bore of bends, elbows, and other fittings shall pass freely a ball 6 millimeters less in diameter than the nominal inner diameter of the conduit. Couplings, elbows, bends, adapters, reducers, increasers and bell ends, shall be of the same material as the conduit. Couplings made of material other than that of which the conduit is made shall be compatible with the conduit and made of an approved tough non-metallic material suitable for the service.

The minimum acceptable radii dimensions for elbows and bends shall conform to the requirements of the National Electric Code. Joints shall be machined to an accurate taper on both ends to permit a tight joint when assembled with suitable couplings or fittings.

One tapered joint coupling shall be supplied with each length of conduit and each elbow or bend.

At least 85% of the conduit in any lot shall be furnished in standard length; sections of conduit less than 1.5 meters will not be accepted. A tolerance of plus or minus 25 millimeters is permissible in the conduit lengths specified.

Plastic conduit and fittings shall conform to Federal Specification W-C1094 for Class II Conduit and Fittings, Non-Metallic, Rigid (Plastic). Included under FSSW-C1094 us UL651 and UL514B.

M5.07.1 Electrical Conduit-Rigid Metallic (Type RM).

Steel conduit, steel plastic coated conduit, aluminum conduit, special alloy conduit, and fittings shall conform to the following:

Class 1 – Type A - Underwriters Laboratories, Inc., (UL) Standard 6 - Rigid Metal Electrical Conduit.

Class 2 – Type A - UL Standard 1242 - Intermediate Metal Conduit.

Class 1 and 2 – Types B, C, and D - UL Standard 514B - Fittings for Conduit and Outlet Boxes.

United States of America Standard USAS C 80.1.

An Underwriters Laboratory, Inc., labeling shall appear on each length of conduit as well as on elbows, bends, sweeps and nipples to identify such as approved.

M5.07.2 Electrical Conduit-Flexible Metallic (Type FM).

Flexible Metal Conduit shall conform to UL-1.

Liquid-Tight Flexible Metal Conduit shall conform to UL-360.

M5.08.0 Pull and Junction Boxes – Metallic.

Metallic pull and junction boxes made of cast iron, welded sheet steel or cast aluminum shall conform to Underwriters’ Laboratories, Inc. Publication UL-514, Outlet Boxes & Fittings.